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ABSTRACT

An assessment team of three industrial arts educators was sent to Utah to evaluate the Industrial Arts Career Exploration (IACE) program. Since its inception in 1975, the program has been implemented in thirty-eight of the state's middle and junior high schools. The major objectives of IACE are to reorient and expand the curriculum of the traditional industrial arts program; to incorporate the educational realities of four industrial-based career clusters (construction, manufacturing, transportation, and industrial communication); and to provide individualized, student-centered, career-related "hands-on" learning experiences. Enthusiasm and support for the program are high on both the student and administrative levels. Economically, IACE has developed at minimal cost. Essentially, it is effective in meeting its career exploration goals, although it does suffer some limitations: (1) the selection of occupations included appears to be arbitrary and too small in number; (2) it fails to establish links between industrial skills and broader career concerns or general consumer interests; and (3) it lacks a careful evaluation of its educational effects. The assessment team developed a list of recommendations, which includes the following: development of a master plan for all levels of industrial arts career exploration; legislation and a national policy from the U.S. Office of Education to encourage improved industrial arts education; further study of and continued funding for the IACE program; and specific activities to be added to the program. (ELG)

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ED169226

Final Report

Contract No. P 00770621

The Feasibility of the Utah Model for Industrial Arts For Serving a Career Exploration Purpose in Middle and Junior High Schools

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NATIONAL INSTITUTE OF EDUCATION

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June 1978

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Special thanks are expressed to Joe O. Luke for his efforts in coordinating the assessment team's sojourn in Utah. Appreciation is also expressed to Neill Slack, Nordell Nervig, the IACE project staff, instructors, and students for their warm and candid response to the assessment team.

Preparation of the final report was based upon the field reports prepared by Ronald M. Hanisch, teacher-supervisor at Monmouth Regional High School, Tinton Falls, New Jersey; Thomas A. Hughes, Jr., state supervisor, Virginia State Department of Education; and Michael R. White, associate professor, The Pennsylvania State University. William J. Schurter, faculty research assistant, University of Maryland, served as coordinator of the report preparation. His efforts were further supported by the able assistance of Kathy Sander and Bonnie Dunn and the office staff of the American Industrial Arts Association. I believe this report reflects the high level of excellence held to by this evaluation team.

Donald L. Rathbun
Project Director

PREFACE

In 1975 the Utah State Board for Vocational Education, through the direction of Joe O. Luke, industrial arts specialist, developed a program designed to serve a career exploration purpose. The program, titled Industrial Arts Career Exploration (IACE), has since its inception been provided in 38 of the state's 115 secondary schools at the middle school/junior high school level. This innovative program has, in effect, expanded upon and redefined industrial arts education in the traditional sense. From a career education standpoint, it would appear to be a most desirable direction for industrial arts education to pursue. Mr. Luke and other industrial arts leaders in Utah obviously agree.

The development of this program involved inventing a number of individualized instructional career exploration simulation activities aimed at assessing the student's interest and aptitude for particular occupational areas. Consultants from the business/labor/industry community were involved voluntarily in helping Mr. Luke and many other industrial arts educators devise these simulation exercises and construct the equipment necessary to carry them on.

There remained a very real and significant problem relative to the extent to which the Utah approach to industrial arts curriculum revision would be acceptable and practical to consider by other industrial arts teachers and specialists. An independent examination and professional evaluation of the Utah model was indicated. It was to this need that the American Industrial Arts Association (AIAA) responded. An assessment team of three industrial arts educators was sent to Utah for site visitations over the period of March 29, 30, and 31, 1978.

This report presents the results of the assessment team's findings. Section 1 of the report is aimed at providing a description of the Utah program in sufficient depth in order that others could, if they desired, replicate it in their Local Educational Agency (LEA). Section 2 outlines the advantages, limitations, and dangers associated with the program. The last section discusses the long-range policy implications for change in the industrial arts field growing out of the Utah model.

CONTENTS

	Page
ACKNOWLEDGEMENTS	ii
PREFACE	iii
Section	
1. THE INDUSTRIAL ARTS CAREER EXPLORATION PROGRAM OF UTAH	1
The Rationale	1
Theoretical Foundations	5
Program Goals and Objectives	8
Program Organization	12
Program Development	18
Facility Planning	29
Summary/Status Report	31
2. PROGRAM ASSESSMENT	34
Advantages and Strengths of the IACE Program	34
Limitations and Dangers Associated with the IACE Program	36
Summary	40
3. LONG-RANGE POLICY IMPLICATIONS OF THE IACE PROGRAM	42
Implications for Teacher Education	42
Implications for Federal/State Legislation	43
Implications for Teacher In-Service Programs	44
Summary	45
REFERENCES	49

Page

APPENDIXES

A. LITERATURE CITED 51

B. TITLES AND ACTIVITY DESCRIPTIONS OF LEVEL I MODULES 53

C. PROJECT BUDGET 57

Section 1

THE INDUSTRIAL ARTS CAREER EXPLORATION PROGRAM OF UTAH

The sharing of experiences gained in attempts to revise existing programs of instruction in any subject is of primary importance. Critical analyses of strengths and weaknesses attributable to specific reform efforts need to be undertaken within a context of appreciation of the difficulties involved. It would be foolish to discourage innovative efforts simply because they are likely to be initially awkward and, perhaps, inevitably less than adequate to the challenge. Only with a clear and detailed understanding of the total revision process at hand can a serious-minded critique be constructively drawn.

Toward the end that this report be constructive, Section 1 presents the Industrial Arts Career Exploration (IACE) program description under the following seven headings: The Rationale, Theoretical Foundations, Program Goals and Objectives, Program Organization, Program Development, Facility Planning and a Summary/Status Report. The final goal of this section is that duplication of the program be made possible. Given the overall complexities, circumstantial directives, and constraints involved, a more realistic goal would be the support of similar efforts through the sharing of more or less unique experiences.

The Rationale

In deference to the seemingly unbroken history of "reformation" activities that have characterized our educational enterprise throughout this century, it was stated in an American Vocational Association (AVA) publication that:

> Because the social and educational needs of any progressive society, nation, or community are continually in a state of flux, and if that

/Editor's note: Reference citations are enclosed in parentheses in the following text. When given, page numbers follow the colon. A list of references can be found on page 49./

> society, nation, or community is to progress, constant reappraisal of its existing programs of education is always appropriate and necessary. It is therefore fitting that those concerned with industrial arts education should periodically undertake a realistic evaluation of its past and present goals with the clear intent of making industrial arts more meaningful in light of the emerging needs of our society. (2:8)

Justification of the IACE program rests heavily on the truth and wisdom of these perceptions. It is taken as fundamental that industrial arts education should be responsive to a changing socio-economic environment; that changes in the technological bases of our modern industrial machinery should be reflected in our industrial arts programs; and that, in general, industrial arts should be responsive to the "emerging needs" of our progressive society.

At the inception of the IACE program in Utah, Luke noted that:

> For a number of years, industrial arts has made important contributions to general education. However, in recent years increasing dissatisfaction has been evident with many aspects of the industrial arts program.
>
> The introduction of new concepts and innovative programs have been the mode during the past decade and a half in all aspects of education, particularly in the junior high industrial arts program. (4:3)

Yet, despite all the innovations, there had persisted a basic 7th, 8th, and 9th grade experience in industrial arts education describable as traditional bench-woodworking, metal-working, and drawing that had, to some extent, raised dissatisfaction in the Utah schools. In rationalizing both the need and the purpose of a career education program, Luke said that:

> The major innovative programs have attained limited success. Consequently the feeling still persists that teaching industrial arts consists of little more than shop work. (4:3)

Luke emphasized a pivotal question that challenges

industrial arts education programs throughout the country. In his 1975 proposal he referred again to the AVA's A Guide to Improving Industrial Arts (2) to raise the question:

> The advent of new and rapidly advancing industrial processes has made many traditional subject areas of industrial arts obsolete in relation to contemporary industrial scenes throughout the country. It must be decided, therefore, if the cultural-historical, leisure time, hobby, and prevocational values are important enough to warrant continuing these traditional subject areas in their present forms, or should means by which they may be supplemented with new and more up-to-date subject content and subject areas be emphasized. (4:3)

The response made by the State Office of Education at this decisive juncture was in keeping with the Utah State Board for Vocational Education having advocated in 1973 that:

> Career education will be a major thrust of the total public education system from the kindergarten through secondary, post-secondary, and adult levels. The State Education Agency will provide the leadership necessary for development and implementation of the career education concept. (10:4)

The need for a coordinated effort to establish career education in the Utah schools was underlined by Luke when he stated that:

> Current efforts to develop a visible career education program have been seemingly limited to oral description, written definitions, paper plans, and good intentions. Career education curriculum activities that have been developed are highly fragmented and large areas of the program remain underdeveloped.... There is a need to develop and implement a program that properly modifies and combines those parts of the existing curriculum in such a way as to yield sets of student experiences that facilitate career exploration and career development. (3:3)

Industrial arts education, properly conceived and operated,

was seen as a viable medium to provide appropriate career exploration learning experiences and to provide leadership for career education in Utah.

It was recognized that a need existed to determine ways, within the educational environment, to provide youth with concrete realistic experiences for self-assessment in relation to the real world of work. These experiences were to provide for individual involvement of the student and be directed toward bridging the gap between school and society.

Luke proposed that:

> The purpose of this program will be to develop and implement an industrial arts career exploration program at the junior high school level. The program will utilize the principles of industrial arts to provide unique experiences that further the discovery and development of each student's career potential, technical abilities, judgement, self-reliance and resourcefulness to succeed as an effective producer and/or consumer in the industrial-technical society. (3:3-4)

The IACE program, therefore, assumes as a major premise the idea that the strength of industrial arts rests in the activities that the student engages in, the relationship of these activities to industry, and the relationship of these activities to careers in industry. Industrial arts education can, in Luke's words:

> ... lead in the development of a pilot program relative to career orientation. It can play an important role in providing students with occupational information, and it can also provide the knowledge to be used as a basis for making tentative and lasting career selections.
>
> By emphasizing the understanding of career opportunities and requirements relating to industry of a specific field of work; by promoting self-understanding and self-direction to develop those traits that will aid in obtaining and maintaining employment; and by affording opportunities for the better understanding of a contemporary society, the junior high age youth will succeed and be better informed with understandings for individualized progress. (3:2)

The program moves emphatically in the direction of supplementing the "obsolete" curriculum of industrial arts with what the AVA publication refers to above as "new and more up-to-date subject content and subject areas." The specific manner in which this "reform" was theoretically grounded, designed, and enacted has been outlined below.

Theoretical Foundations

Slack and Nervig (9:3-6) have provided a concise summation of the theoretical position that was assumed by the IACE project staff. They state:

> In the development of the IACE instructional materials, career development theories were examined and the main concepts were integrated with learning theories to provide a learning framework that was needed to translate career development theories into methods and techniques that are appropriate for youth. The main concepts and principles utilized as a basis for the structure of the instructional materials were as follows:
>
> ### Career Developmental Theory
>
> Major theories of career development view occupational choice as a process which takes place over a period of several years and encompasses many related occupational decisions. It is an on-going, continuous, generally irreversable process, and it is an orderly, patterned process (Super, 1957).
>
> The age or grade at which occupational tasks are first encountered and which become the basis for occupational choices has not been determined empirically, but Ginzberg, et al., (1951) have hypothesized that the choice process probably begins sometime during the later elementary years. Research has demonstrated that elementary grade children possess greater "occupational readiness" than theorists acknowledge and suggest that youth can and must be prepared to choose. McDaniels (1965) contends that children are not too young to make choices, but only too poorly prepared to do so.
>
> From a developmental point of view, few youth are able to assess their interests and

attitudes fully and realistically without working in a variety of occupational areas; i.e., without "hands-on" experiences. A "hands-on" experience as defined by Hooks (1972) should provide the following:

1. 100 percent participation of the student in an activity that produced a visible end result.

2. The use of tools and skills as an extension of self.

3. The emphasis and skills as they relate to a complete job.

4. A conscious effort to relate the activities used to the actual job situation.

5. An emphasis on tools and skills as they relate to occupations in the world of work.

Student-Centered Curriculum

It is necessary that the curriculum be defined and developed in such a way that the psychological structure of students is considered. The curriculum must provide participation exercises which provide a vehicle for learning experiences to occur. The experiences should be controlled by the student for his own use in self-evaluation with assistance presented at the student's request. This will provide the student with the feeling of having his own personal part of the education effort to run, together with a feeling for the importance of his own individualized efforts. The rate of movement through the activity must be one that is comfortable for the student (Tuchman, 1969).

Student-centered curriculum makes use of multiple instructional strategies, allowing students to learn through interaction with their environment, utilizing all sensory modalities. It is contended that learning is an experience which requires that the conditions under which it is likely to occur be structured.

Concrete Manipulative Experiences

In terms of learning style, learning of

the concrete must precede learning of the abstract. Piaget (1972) has shown that children learn concrete operations before they learn abstract operations and that, moreover, abstract operations cannot be learned unless concrete operations are learned first. In general, children function more successfully in the concrete realm than in the abstract.

For Gagne (1970), in the instructional program the child is carefully guided. He may work with programmed materials by following quite explicitly a step-by-step guide. He is not passive; he is doing things, he is working exercises, he is solving problems. But the sequence is determined entirely by the program. Gagne feels that capabilities are learned in a sequential manner. He begins instructional development with a task analysis. He always asks the questions, "What is it you want the learner to be able to do?"

Gagne's position is that there are levels of cognitive development within each task: signal; stimulus-response; chaining; verbal association; multiple discrimination; concept learning; principle learning; and problem solving. He suggests that teachers should ascertain that the learner has mastered all prerequisites before teaching him new tasks. Instruction in new concepts should follow the sequence of the eight levels of development.

The concepts and principles of career development and learning theories defined above provided the basis for the structure and learning framework for the methods and techniques used in the modules. Specific emphasis at the initial level was on the affective domain of learning which is concerned with behavior which emphasizes attitudes, emotions, and values of the learner which are usually reflected by interests, appreciation, and adjustments.

A list of "Literature Cited" used by Slack and Nervig (9:20) appears in Appendix A.

In summation, the IACE program is based on the following three fundamental principles of learning:

1. Career development necessitates "hands-on"

experiences at junior high school age.

2. Individualized participation exercises utilizing multiple instructional strategies should form the basis of the student-centered curriculum.

3. The instructional program should be organized in terms of activities that have been sequenced from the simple/concrete to the difficult/abstract.

How the recognized need for career exploration combined with this "learning framework" resulted in the IACE program in Utah has been discussed under the remaining four headings of this section.

Program Goals and Objectives

The IACE program was originated by Joe O. Luke, state specialist for industrial arts education, and coordinated by Neill Slack, Head, Industrial and Technical Education, Utah State University. Under their direction the IACE program was initiated to provide career exploration learning experiences for middle school/junior high school students. The Utah State Board for Vocational Education provided specific directions for such a program by holding that:

> ... the junior high or middle school curriculum will focus on career orientation and exploration with continued development of foundation skills and attitudes. At this level, students will have the opportunity for in-depth exploration of different job families and to acquire information about themselves, their interests, and talents and how these can be transferred into career opportunities. (10:3)

Luke, then, maintained that:

> Due to the unique nature of its curriculum, industrial arts is in an enviable position to provide appropriate career exploration learning experiences and to lead out in career education. (4:7)

It was held by Slack that the appropriate

> ... teaching methods or process used to illustrate abstract concepts related to both life goals and subject goals are: field trips, interpersonal interaction, manipulative activities, multi-media, guest speakers, simulation, and career guidance. The primary focus of the process is the use of "real" experiences to illustrate abstract symbols and concepts related to self, education, and careers. (7:1)

Resting on these directives and beliefs, the IACE program developed from both the perceived need to make industrial arts education more relevant to industry and the intent to provide middle school/junior high school students with career exploration experiences and activities centered around career clusters. The major objectives of the plan to establish IACE were (1) to reorient and expand the curriculum of the traditional industrial arts program; (2) to incorporate the educational realities of four industrial-based career clusters; i.e., construction, manufacturing, transportation, and industrial communication; and (3) to provide individualized, student-centered, career-related, "hands-on" learning experiences for middle school/junior high school students, both girls and boys. Slack has commented in retrospect that:

> It was very important that the goals and general objectives be chosen and communicated so as to be clearly understood by the instructional designers in order that expected outcomes could then be identified. (9:6)

The original program proposal (3:4) tied development of specific curriculum materials to "the six goals delineated in the Guidelines for Industrial Arts, AVA, and AIAA, 1974." They are:

> 1. (Technological Literacy) Provides an insight and understanding of industry and its place in our culture.
>
> 2. (Self-Identity) Assists in the discovery and development of talents, attitudes, interests, and individual potentials related to the industrial-technical field.
>
> 3. (Competencies) Aids in acquiring skills in the proper use of tools, machines, and processes.

4. (Intellectual Development) Furthers the development of problem-solving and creative abilities involving materials, processes, and products of industry.

5. (Infusion) Provides an opportunity to make other school subjects more meaningful and relevant.

6. (Career Development) Brings about an understanding of career opportunities and requirements in industrial pursuits and develops traits that help obtain and maintain employment.

According to Slack (9:7), "The goals were further refined and converted to operational terms by the process of defining general objectives to be used as guidelines for developing the instructional program." The project proposal (3:4-5) stated that:

The general objectives of the program are:

1. To develop student-centered learning experiences designed to meet the educational needs of the student. These learning experiences will be goal-oriented and will reflect the progression from concrete to abstract, using the industrial arts experiences as a context for concrete learning as well as a way of providing young people with career relevant experiences. The learning experiences will be individualized and developed based on the following criteria:

a. Projects and activities will be relative with modern industrial tools, equipment, materials, processes, and techniques.

b. Projects and activities will be developed in accordance with physical and intellectual growth patterns and individual differences.

c. Projects and activities will be based on successful experiences in order to improve personal confidence and self-image.

d. The learning experiences will progress sequentially from the concrete to the abstract.

e. Projects and simulation activities

will be prepared for boys and girls (co-educational) consistent with the State Board of Education policy.

f. The instructional program design will be an open-entrance, open-exit system.

g. Projects and activities will be non-graded.

h. Projects and activities will be designed to encourage student initiative and personal responsibility.

2. To utilize an industrial-based cluster concept to provide career related learning experiences based on the major occupations that normally comprise the bulk of human effort in the industry. Four (4) industrial-based career clusters have been identified to be used in this program. They are:

-Transportation
-Industrial communication
-Construction
-Manufacturing

Selection of the occupations within each cluster will be the identification of occupations that have certain inherent commonalities and will be based on the following criteria:

a. Facilities, tools, and equipment

b. Teacher experience and educational background

c. Employment projections

d. Cluster arrangements

e. Worker trait groups

3. To provide career related information that is closely coordinated with the career activities of the program. Career development will then become an integral part of the student-centered learning experiences.

4. To identify the competencies that are necessary for the teacher to effectively function in the environment created by the student-centered curriculum and make

recommendations for teacher education which will provide for teacher attainment of the competencies identified.

It was the purpose of the instructional materials developmental phase to create sufficient career exploratory learning experiences to encompass approximately one semester of study. The instructional materials have been developed and tested at the prototype level based on these four general objectives. A description of the IACE program in its final formulation and its developmental stages has been presented under the next two headings of this section.

Program Organization

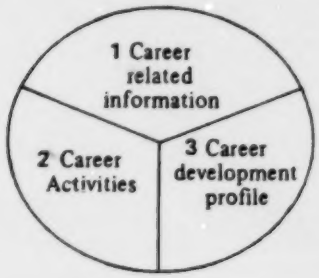
The following description of the IACE program was taken from the Utah Industrial Education Association (UIEA) Journal (4:9-12):

> The IACE program is a mixture of Career and Industrial Arts Education. The program is organized around the industrial-based cluster concept to provide individualized student centered, "hands-on" learning experiences which effectively meet the needs of junior high school students.
>
> The clusters are:
>
> | | |
> |---|---|
> | Construction | Industrial communication |
> | Manufacturing | Transportation |
>
> The learning activities are:
>
> -Relative with industrial tools, equipment, materials, processes and techniques.
> -Designed to incorporate multiple instructional strategies.
> -Designed for successful "hands-on" experiences.
> -Developed in accordance with physical and intellectual growth patterns and individual differences.
> -Designed sequentially from simple to complex.
> -Designed to encourage student initiative and personal responsibility.

-Designed for elective non-graded student enrollment.
-Co-educational

The IACE curriculum incorporates three dimensions of learning.

The dimensions of learning are:



1. The CAREER RELATED INFORMATION provides the student with information about careers within the clusters. The information is directly related to the career activity experiences of the program.

This information is based on the following criteria:

-What is the occupation all about?
-What, exactly, does the person do?
-What is the working environment?
-What are the education and training requirements?
-What are the job prospects?
-What are the likely salary ranges?

2. The CAREER ACTIVITIES are developed around the occupations of each career cluster.

Career activities are divided into two categories:

-Useful student projects
-Industrial simulations

3. The CAREER DEVELOPMENT PROFILE emphasizes:

-The relationship of each occupation identified with a career activity to data, people, and things,
-Identification of likes or dislikes

toward each career activity, and
-Encourages students to start formulating a career identity. (4)

The career development profile aspect of the IACE program has been elaborated upon by Gary Singleton, a participating teacher in the IACE program. In terms of actual classroom practice Singleton (6:5) explains:

> The Dictionary of Occupational Titles (DOT) has become such a standard source of occupational information in the career selection field that this important text was adopted for use in the Industrial Arts Career Exploration program. This book contains job titles and specific information about each occupation listed. Another important aspect of the book contains a numerical listing to match the student's ability and interest in working with DATA, PEOPLE, and THINGS. As each student would complete an activity, they were required to complete an evaluation and questionnaire of the career unit. The Dictionary of Occupational Titles would be the main source for the student to obtain the information.
>
> The new CAREER EXPLORATION program has three sequential levels: a modular structure concept has been incorporated for Level 1. (4)

/Editor's note:/ An exact description of an instructional module is not included in the program outline being quoted. Luke's description of a module as it was presented in his proposal states that:

> The student-centered modules will be grouped so that the learning experiences are sequenced at three instructional levels reflecting a progression from the simple to complex. The three levels are: 1) basic, 2) intermediate, and 3) advanced. All three (3) dimensions of the module, i.e. career activities, career related information, and career development, are sequenced on this continuum in terms of the nature of skills, competencies, or knowledge that need to be facilitated. (3:9-10)

Slack explained further that:

> Each module consisted of a simulation of a complete job from a specific occupational area utilizing the actual tools and equipment required in the trade. Instructions and procedures for completing the job were provided on an audio cassette tape and a procedure manual which has a visual and a brief written description for each step. The audio-visual program provided the means by which the activities were paced and controlled by the learner. Care was taken in the design of the module to provide an environment that resembled as closely as possible the environment found in the occupational area itself. It was not the intent of these modules to develop specific skills, but rather to provide activities that would enable the student to perceive his interest and attitudes toward a particular occupation. (9:13)

Continuing with the program description (4)...

The modular units include a:

-self contained tool carrel
-construction section, or
-mock-up, with--
-pictorial procedure manual
-coordinated with an audio tape

A total of fifty Level I career modular units have been developed and others are under development. The units, according to this program description, are (4):

CONSTRUCTION	MANUFACTURING
*Architect	*Electric Appliance Repairer
*Bricklayer	*Electronics Assembler
*Cabinet Maker	*Foundry Worker
*Carpenter	*Furniture Upholsterer
*Cement Mason	*Jeweler
*Dry-wall Applicator	*Leather Worker
*Electrician	*Machinist
*Glazier	*Metallurgist
*Plumber	*Ceramic Caster
*Surveyor	*Ornamental Iron Worker
*Tile Setter	*Ornamental Metal Worker
*Floor Covering Installer	*Electroplater
*Roofer	

*Painter
*Paper Hanger

TRANSPORTATION
*Aerospace Engineer
*Aircraft Designer
*Airplane Pilot
*Auto-body Repairer
*Auto Service Station Attendant
*Bicycle Repairer
*Gas Engine Repairer
*Boat Builder
*Auto Service Mechanic
*Electrical Motor Repairer
*Sports Equipment Repairer
*Sheet Metal Worker
*Textile Worker
*Combination Welder
*Fly Tier
*Plastics Worker

INDUSTRIAL COMMUNICATION
*Announcer
*Compositor
*Drafter
*Illustrator
*Sign Painter
*Photographer
*Screen Printer

/Editor's note: Appendix B of this report gives a slightly different list of module titles and associated learning activities presented by Slack (9) as having actually been developed in prototype as of December, 1977./

A CAREER ACTIVITY PACKAGE SYSTEM (CAPS) has been developed for Level II and Level III. The CAREER ACTIVITY PACKAGES for Level II are simple, predesigned, individualized career activities.

The CAREER PACKAGES include:

*Career related information
*Student project or activity directions
*Career evaluation

The CAREER ACTIVITY PACKAGES are supported by:

*Machinery operation packets (MOPS)
*Power tool references (PTR)
*Machinery information references (MIR)
*Hand tool references (HTR)

The MACHINERY OPERATION PACKETS include:

*Machine Description
*Film Reference(s)
*Text Reference(s)
*Machine Nomenclature
*Machine Adjustments
*Machine Operations
*Safety Text
*Teacher "Check-out"
*Safety Rules

The POWER TOOL REFERENCES include:

*Power Tool Description
*Power Tool Operation Directions
*Power Tool Nomenclature
*Text Reference(s)
*Safety Rules
*Safety Test
*Teacher "Check-out"

The MACHINERY INFORMATION REFERENCES include:

*Machine Description
*Machine Operation Directions
*Text References
*Machine Nomenclature
*Safety Rules
*Safety Test
*Teacher "Check-out"

The HAND TOOL REFERENCES include:

*Picture of Hand Tool
*Utilization
*Text References

Level III incorporates more complex pre-designed CAREER ACTIVITY PACKAGES and provides a system for advanced students to research and design their own personal career related projects and activities.

The new CAREER EXPLORATION program also incorporates an individualized mass-production system.

This system includes:

*A mass-production center (bench)
*Individualized procedure manuals
*Coordinated with an audio tape

The PRODUCTION CAREERS are:

*President
*Safety Engineer
*Plant Manager
*Accountant
*Quality Control
*Foreman
*Cut Off Operator
*Drill Operator
*Assembler
*Power Sander
*Hand Sander
*Stainer
*Finisher
*Burnisher
*Packager
*Labeler

The process whereby this program design was developed has been discussed under the next heading.

Program Development

The success which the IACE program has experienced is attributable in some indefinite degree to the unique qualities of its leadership. Any attempt to duplicate this program in another state, however, might well be facilitated through an appreciation of the process of development undergone by the IACE in Utah.

One of the early developers of the program, Luke recounted that:

> The embryonic idea for the IACE program or concept, cannot and should not be credited to a single source or individual. The idea was a product of extensive discussion, abundant conversation, and consensus of opinion. The late Jake Aimsworth, Larry Petersen, industrial arts teachers, state specialist, teacher educators, the State Vocational Directory, local vocational directors, and the State Advisory Council for Industrial Education all made significant contributions during the early period of incubation. (4:7)

A perspective on the dimensions of this large scale effort was given by Luke (4:7-9) as he continued his reflections on the early period of the project's development:

> Concluding many years of contemplation, a decision was made by the State Specialist to reduce the talking to writing and devise a documented plan, a plan to fuse together the established strengths of the traditional and experimental industrial arts programs with modern innovative ideas and concepts which would provide a foundation for a new industrial arts career exploration program. ...
>
> At this point in time, a proposal was formed in cooperation with Davis, Granite, Iron, Logan, Nebo, Washington, and Weber School Districts to develop an "Individualized Industrial Arts Career Exploration Program." These districts were selected because of natural circumstances, and in some cases by coincidence.
>
> The proposal was submitted, with the approval of the State Director for Vocational Education, to the Associate Superintendent for Adult, Vocational, and Rehabilitation Services, and in turn, to the State

Superintendent of Public Instruction. After eight (8) months of negotiations the proposal was approved and the opportunity to improve the junior high school industrial arts program became a reality.

After the proposal was approved, a staff was selected, teachers were identified, and final preparatory plans were completed to start the wheels in motion. ...

Program developmental standards and guidelines were specified in the proposal and directives provided to the teachers. However, a considerable amount of latitude was left to the discretion of the team. The first ground rule adopted by the team established the rigid requirement for unanimous group approval prior to any action or development of any nature. Unanimous group approval was required for virtually every idea in order for a member of the group to proceed with an activity. Each member of the entire team had to approve it. It must be said that a unanimous vote is difficult in any situation where Roberts Rules of Order prevail. This group of teachers proved they were no exception. However, in retrospect, it was definitely the correct procedure.

Major developmental work began on Monday, June 16, 1975. The staff, and for all practical purposes, a group of twenty (20) unacquainted industrial arts teachers assembled at Utah State University to transform a paper plan into an operational individualized Career Exploration Program for Industrial Arts.

The original IACE team included Joe O. Luke, Director; Neill C. Slack, Co-director; Nordell Nervig, Instructional Technologist; Loren Palmer, Assistant for Engineering and Production; Austin Loveless, Assistant for Media Development; Carl Wallis, Special Assistant; Ray Andersen, Roger Douglas, and Virgil Steel of North Layton Junior High School; Gary Campbell, George Elmer, and Gary Singleton of Kennedy Junior High School; Douglas Gray, Stuart M. Smith, and Jack Christensen of Logan Junior High School; Tom Isom and Lee Abraham of Dixie Junior High School; Monte Foster and Gordon Card of Sandridge Junior High School; LaVoy Starley,

Ronald LeFevre, and Jr. Seeley of Cedar City Junior High School; Ronald Braithwaite and Lee R. Hill of Payson Junior High School; and Calvin E. Ewell and Stanley Snow of Spanish Fork Junior High School.

In his 1975 proposal Luke stated that:

> A diversified advisory committee will be established and maintained for the duration of the proposed project. This committee will include representative teachers, administrators, counselors, parents, and industry personnel. (3:7)

It was further indicated that:

> The program will be coordinated with the following personnel and agencies:
>
> 1. State specialist for educational programs
> 2. State specialist for counseling
> 3. General Education Division
> 4. Research Coordinating Unit (RCU)
> 5. Utah Industrial Education Association
> 6. State Industrial Education Advisory Council
> 7. Career Education Task Force
> 8. Project proposal advisory committee
> 9. Other

A "project budget" for fiscal year 1975-76 submitted by Luke with his 1975 proposal has been included in Appendix C of this report.

Slack and Nervig explained that:

> The staff and facilities of the Industrial and Education Department (ITE) and facilities

of Utah State University were made available and were utilized extensively during the developmental phases of the project.

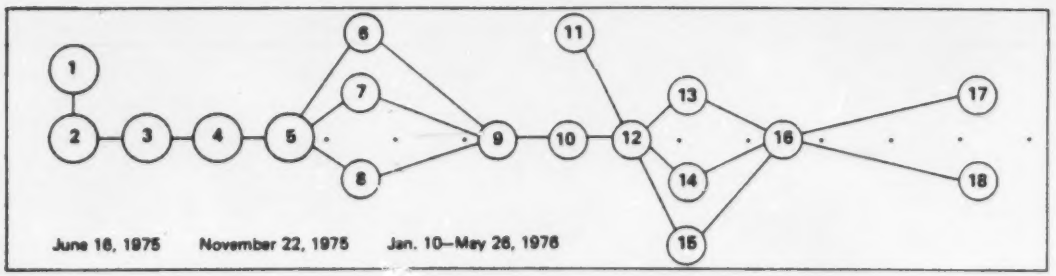
The developmental scheme of the program evolved around a systematic approach to instructional design. The task was to develop a total system which would incorporate the best instructional management and media mix to achieve the goals of the program. (8:4)

An article by Slack and Nervig (8) titled "IACE Program Development" has been quoted extensively below in order to provide a detailed developmental account of the IACE program:

The program was developed in two phases which may be best explained by using a modified PERT network and briefly describing the sequence of events.

PHASE 1 (March 1975 - May 1976)

The primary objective of Phase 1 was to design and develop student-centered instructional materials based upon the goals and objectives of the Industrial Arts Career Exploration program that would encompass one semester time period. These materials were then produced in sufficient quantity for the seven participating school districts to conduct a field test. Forty self-contained modules were developed, reproduced for each school, and field tested in Phase 1 according to the following schedule of events.



1. Program Formulation. An early task of the design team was to make an assessment of educational needs. This assessment, in

turn, was used to formulate the rationale, goals, and general objectives of the program and was accomplished prior to the June 16 starting date.

2. Occupational Titles Identified. The next step was to identify occupations within each of the four clusters that could be developed within the limitations of the program. Forty occupational titles were identified by the design team, with approximately ten in each cluster.

3. Team Assignments. Each of the twenty members of the design team assumed responsibility to develop instructional materials for two of the occupational titles.

4. Instructional Specifications Completed. Each designer had to identify an activity, which represented a complete job, that could be realistically and efficiently programmed into a learning experience that was meaningful to the learner and that was within the constraints of the program. An analysis was then made to assure the actual tools and equipment required for the job were utilized and to identify the tasks to complete the activity.

5. Team Approval of Activity. Before the designer could proceed with the instructional development, the activity as specified had to be accepted by a consensus of the team members.

The next three events were for the development of the prototype products and were not necessarily developed in sequence. It had been determined that multiple instructional strategies in modular structure were to be used to facilitate individualization of the learning experiences.

6. Career Development Material Completed. This material was programmed to provide the student information about careers that are related to the occupational title and activity that they are experiencing. The relationship of each occupation to data, people, and things is emphasized in career related information (CRI), career decision/choice, and in career activity.

7. Software Completed. Each activity was

programmed to be self-directed in that the activities are controlled by the student for his own use. Instructions and procedures for completing the job are provided on an audio cassette tape and a procedure manual which has a brief written description and a photo for each step of the procedure.

8. Hardware Completed. To provide an environment that resembles as close as possible the occupational environment, a modular structure was used utilizing actual tools and equipment required in the trade.

9. Prototype Assembled. The elements were brought together as a prototype module.

10. Team Approval of Product. The assembled prototype module was reviewed by each member of the team and approval had to be received before the designer could proceed with the testing of the module.

11. Test Students Selected. Students were selected that were representative of the target population to test each of the prototype modules.

12. Pilot Test Completed. Each module was tested by having at least three students that were representative of the target population go through the entire activity. The designer observed and made notes of any discrepancies.

13. Revision Completed. Discrepancies noted during the pilot test were corrected and the program was retested until the designer was satisfied that the specified criteria had been achieved, and that the material was validated at the prototype level.

14. Software Reproduced. It was necessary to reproduce ten sets of the software for 40 modules, to be field tested in the school environment. 10,400 pages and 18,000 black and white prints were reproduced and assembled into the required prototype procedure manuals. 400 audio cassettes were reproduced and labeled.

15. Hardware Reproduced. Ten sets of 40 modules were reproduced for a total of 400. Tools and equipment for each of the modules

were ordered or made and mounted. Supplies for approximately 1,350 students were ordered and packaged for each of the schools.

16. Reproduced Modules Assembled. The software, hardware and student material was assembled and disseminated to eight schools by the end of November, 1975.

17. Field Test Completed. During the spring semester of 1976 the field test of the Industrial Arts Career Exploration program's instructional materials was conducted in the eight participating schools. Approximately 1300 students participated in the program.

18. Field Test Evaluation Completed. A formative evaluation was conducted during the field test operation to determine the adequacy of the procedures and to identify what management, operations, and facility contingencies are critical to the operation of the module in the school environment. Interviews, observations, and questionnaire data was collected and analyzed.

Luke contributed the following recollections to the developmental picture:

The team designed, engineered, and developed 40 operational career modules during the summer of 1975. This was truly a remarkable feat. The reaction from program observers and visitors was consistent. They were completely amazed with the innovations, quality of workmanship, and especially with the quantity of work produced.

Summer ended a little too soon and it was necessary for the team to complete the work on the modules during the first semester of school. The IACE program was officially inaugurated and field tested in the eight pilot schools during the second semester of the 1975-1976 school year.

Three additional teachers joined the team in June of 1976. They were Darrell Anderlin, Kennedy Junior High School; Jack Buckmiller, Olympus Junior High School; and David Monson, North Davis Junior High School. Also, Bill Sorensen, Bryant Junior High School and Jay

Hicken, Utah State University were employed as special consultants. George Elmer transferred to Granger High School; L. C. Seeley, Calvin Ewell, and Stanley Snow, for different reasons, were unable to participate in the summer activities for 1976. Also, Gary Singleton and the project director were in Egypt for the first part of the summer.

On Monday, June 14, 1976, the IACE team regrouped at Utah State University to revise and modify the Career Modules, and to initiate the development of an individualized mass-production, and a Career Exploration Program for Levels II and III. (4:8)

Slack and Nervig (8) continued their description of the developmental process of Phase II as follows:

PHASE II (June 14, 1976 - May 1977)

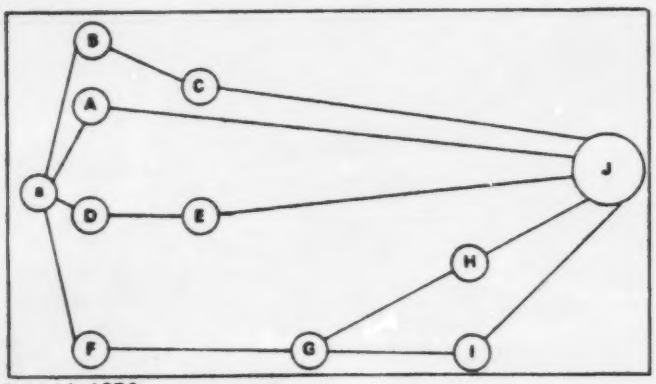
The objectives of the design team for Phase II were to:

1. Revise/modify Level I instructional materials based on the results of the field test evaluation analysis.

2. Design/develop instructional materials for Level II learning experiences.

3. Design/develop instructional materials for an individualized mass production package.

Again, the developmental efforts will be described by using a modified PERT chart and briefly describing the schedule of events.



June 14, 1976

Preplanning. A series of meetings of the design team with staff were held leading to the plan for the summer workshop.

A. Level I Modules Revised. Revision was made on 38 of the 40 modules that were field tested in Phase I. Evaluation data suggested that two modules were not appropriate for Level I. Also, it was decided that during the revision cycle that all instructional materials be converted to metrics. Three members of the design team were assigned this task.

B. Additional Level I Modules Developed. Evaluation data suggested that the number of modules should be increased and that additional occupational titles not included previously be developed. As a result, seven new modules were developed using the same development procedures that were followed in Level I.

C. New Module Pilot Test Completed. Each of the seven new modules were pilot tested according to the procedures specified in Level I. Five members of the design team were assigned to this task and it was completed by July 2, at which time the five members shifted to start work on the Level II instructional material.

D. Mass Production Prototype Developed. It has been determined that as an integral part of the exploratory program a learning experience in mass production be included in order that the students could explore experiences oriented toward production technology and which would expose them to additional working traits, such as management, human relations, and group processes. These worker trait groups are not normally part of the industrial arts program. Seven team members were assigned to complete this task.

E. M. P. Pilot Test Complete. Following the specifications of instructional development the mass production package was tested using 7th grade of the target population. Revisions were made and the package retested until the instructional material had been validated at the prototype level. This was completed by the 14th of July and the team members then were assigned to develop Level II career activity packages.

F. Formulation Level II Instructional Products. During the preceding spring, the design team had several meetings to formulate what the instructional strategy of Level II should be. A tentative plan as to the scope of these learning experiences had been established.

G. Design of Level II Learning Experiences Completed. Four team members were assigned to complete this design phase. They developed a system utilizing applied learning experiences. This system moved away from the self-contained modules but remained student-centered individualized instruction. The method utilized contained two elements:

1. Career Activity Packages (CAPS). These packages contain the same three dimensions of learning as the Level I materials but lead the student toward more independent applied learning and introduces him to use industrial equipment in the shop. The CAPS are basically an extension of the occupational titles utilized in Level I.

2. Equipment and tool packets which are titled as follows:

Machine Operation Packets (MOPS)
Machine Information References (MIRS)
Power Tool References (PTRS)
Hand Tool References (HTRS)

H. Equipment and Tool Packets Completed. Two team members developed the equipment and tool packets. These packets (MOPS, MIRS, PTRS, HTRS) were developed to encompass the majority of tools and equipment in the shop area.

I. Career Activity Packets Completed. Team members, as they completed their initial assigned tasks, moved to developing CAPS in their areas of interest. The ultimate goal is to have a bank of hundreds of these CAPS available in the system.

J. Reproduction Completed. The following material was reproduced at USU and disseminated to the nine participating schools.

1. Revised Level I procedure manuals (35).

2. Additional new module procedure manuals (7).

3. Revised and new audio cassettes.

4. Equipment and tool packets (20).

5. Career activity packets (19 with 36 activities).

An operational field test of the revised Level I instructional material started at the beginning of the fall semester, 1976, and will continue throughout the school year. It is anticipated that the majority of the discrepancies have been corrected. However, some problems not previously detected will be corrected and revised. It is felt that the Level I material will be ready for broad dissemination by January 1977.

Level II instructional materials that have been developed, to include the mass production exercise and career development material, will be field tested starting in December and continuing throughout the reaminder of the school year. The design team will continue to generate additional learning activities and these materials will be reproduced and fed into the system during the field test. Evaluation data will be collected during the field test and the instructional material will be revised and retested based on this data.

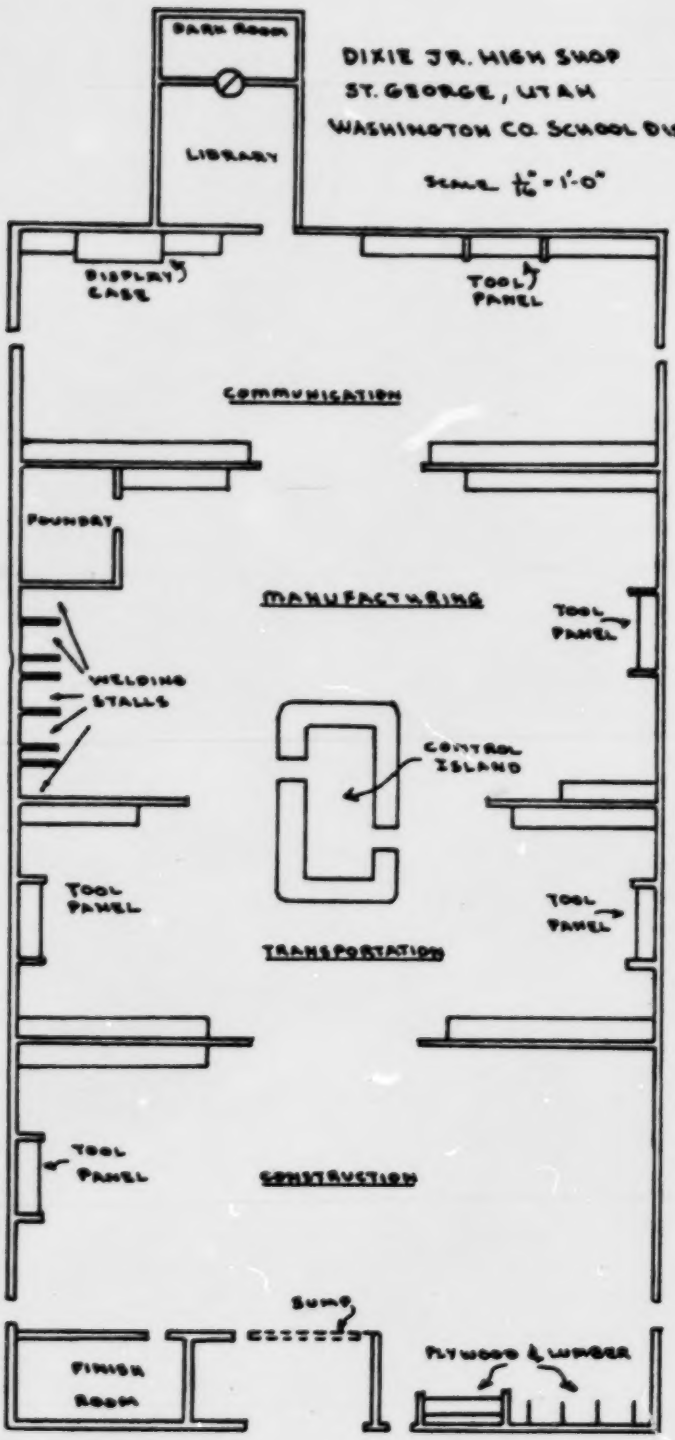
In concluding their article on program development, Slack and Nervig noted that:

> The development of the Industrial Arts Career Exploration Program involved a series of procedures which had both feed-back and "feed-forward" relationships among them. The "systems approach" to the design of the instructional material was based on the one hand in logical, systematic thinking and planning, and on the other hand upon empirical test and fact finding. As a result, an effective instructional program has been developed. (8:18)

Facility Planning

The design and construction of a new shop facility at the Dixie Junior High School in St. George, Utah coincided with the planning and implementation of the IACE program. The opportunity to coordinate the design of the shop with the program that was to be conducted in it resulted in certain deviations from traditional general shop arrangements. Lee Abraham, who was to teach in the new facility, has presented the following description of the shop.

> This facility has been designed with the idea of implementing the pilot program entitled "Industrial Arts Career Exploration."
>
> The shop has been designed around an open concept to allow students to rotate among the different areas.
>
> Note that the shop has been divided into the four career clusters mentioned previously. There is a short partition wall about four feet high partially separating these four areas. Although there is some overlap, most career activities take place within their respective career cluster.
>
> Within and attached to the four main cluster areas are several specialty areas in the shop. These are the dark room for use in exploring careers such as photographer, offset press operator and electronics assembler or engineer; the library for viewing of audio visual materials and placement of some graphic arts equipment; the foundry area for exploring careers such as foundry worker, forge shop worker and jeweler; the welding area which contains four individual brick stalls for arc welding and one for oxy-acetelyne welding. The control island, which will be described in more detail later, and the finish room and clean-up area are on the south end of the shop.
>
> The shop has been designed to allow visual supervision of the entire shop from almost anyplace ir the shop except the dark room and finish room, though the finish room door does have a glass window.



The control island in the center of the shop is elevated slightly to allow better visual supervision when instructors are in

this area. The control island also houses the shop's own P. A. system with speakers located in each of the cluster areas as well as in the library. Within a few feet of the control island are the main power shut-offs for the shop.

Student project storage is provided in various sized lockers mounted under floor benches or under cabinets along partition walls. There is project storage space in the finish room and there have also been several over-sized lockers placed in the hall outside the shop for shop use.

Supply storage has been provided for in the following areas: (1) upper and lower cabinets in the dark room, library, and main shop; (2) lockers, drawers, file cabinets, and book slots under tables, benches, and in the control island; (3) vertical rack and flat storage for metal; (4) plywood and dimension lumber racks; and paint storage cabinets in the finish room.

A central dust system, large hood and exhaust system over the welding and foundry areas, small engine parts recirculating wash tank, hot water cleaner, floor sump, exhausted spray booth and exhaust system for the small engines area are some of the elements which will help in keeping the shop a safe, tidy, and sanitary place to work.

The equipment and tools which were placed in the shop were chosen after giving consideration to the following items: equipment already in the old facilities, equipment needed to complete activities developed by the IACE team, the physical and mental abilities of the students who would use the machines, analysis of cost as well as quality, utilities or hookups which could or would need to be placed in the shop to operate machines and equipment, relevance of equipment to the actual careers students would be exploring, and versatility in case of a change in program. (1:6, 20-21)

Summary/Status Report

Directed by Joe O. Luke, state specialist for

industrial arts education, and coordinated by Neill Slack, Head, Industrial and Technical Education Department, Utah State University, the Industrial Arts Career Exploration (IACE) program was initiated in 1975 to provide career exploration learning experiences for middle school/junior high school students. The Industrial Arts Career Exploration program is a combination of career education and industrial arts education. It is formulated around four career clusters (construction, manufacturing, communications, and transportation), which are quite widely accepted by the industrial arts profession. The program focuses on occupations with the intent of meeting the career exploration interests of students. Its organization provides individualized student-centered, "hands-on" learning experiences that should appeal to middle or junior high school students as they sample tasks or activities of certain jobs.

IACE is a three level program. While it is universally an individualized student-centered, "hands-on" learning experience, it evolves from a complete self-contained carrel at Level 1, to Level 2 where self-instructional units permit students flexibility to pursue areas of greatest interest throughout the laboratory, to Level 3 where self-instructional units combine with individual problem solving or project development with increased flexibility of program and facility utilization.

Each Level 1 module contains three dimensions of learning; i.e., career activity; career related information; and career decision/choice. Each module provides a non-graded, reality-based work experience that is programmed to be self-directed in that the activities are controlled by the youth for his or her own use in self-evaluation. If required, assistance is available at the student's request. The monitoring required by the teacher is similar to that provided by a shop foreman; i.e., encouragement, brief comments, and repetition of instructions previously given in the program.

Currently, Level I is approximately 90% complete and has been presented in 38 of 115 secondary schools. Levels II and III are approximately 30% complete and ready for implementation and further testing. Level II has been distributed to a majority of the schools. It is expected that Level III will incorporate more complex predesigned Career Activity Packages or will provide the student with the opportunity to design his or her own activity ("hands-on" project) in light of previous experience with Level I and II. Inasmuch as the program has been operational for only three years, it is still undergoing development and change.

Level I career experiences are designed to be

completed by the student in one to two hours. Level II experiences may range from two to fifteen hours. Level III experiences will range from ten to thirty hours, depending on the nature and complexity of the activity. Some Level III activities are being designed and tested for a group manufacturing experience.

Over fifty modules at Level I (7th grade) are commercially available through Career Research Corporation, P. O. Box 151277, Salt Lake City, Utah 84115. These units are commercially available for about $600.00 per module. They are based upon the concept developed in IACE, but there may be some differences between these commercially available units and the IACE developed modules.

Career education is seen by the educational leadership in Utah as a thrust that has merit for directing education to providing youth with awareness, exploration, and preparation for careers. As part of this thrust, the Industrial Arts Career Exploration Program (IACE) was generated at the local, university, and state department levels. IACE grew out of the perceived need to make industrial arts more relevant to today's technology and industry combined with the intent to provide middle school junior high school students with experiences and activities centered around the industrial clusters. The next two sections of this report have attempted to provide critical assessment of the degree to which program goals have been realized by IACE and the potential implications for industrial arts associated with adoption of this career education approach.

Section 2

PROGRAM ASSESSMENT

An assessment of the Industrial Arts Career Exploration program in Utah is presented in the following two sections of this report. The opinions and interpretations expressed below have been developed out of a three day visit to the Utah program by three industrial arts educators. With the benefit of having a concrete implementation of the program to which to respond, the following comments have been offered under two headings: Advantages and Strengths of the IACE Program, and Limitations and Dangers of the IACE Program.

The Advantages and Strengths of the IACE Program

One of the objectives of industrial arts has always been to provide students with information and experiences that will permit them to explore their abilities and preferences for industrial occupations. The IACE program makes a concerted effort to provide the student with job related information about specific occupations that appear in the Dictionary of Occupational Titles (DOT). This program systematizes the multiple activity approach to industrial arts, and because it is individualized, it provides for open-entry, open-exit kinds of programming. The "hands-on" learning activities are brief and provide the students with exposure to many different kinds of industrial activities (drilling, threading, weaving, lettering, lay-outing, bending, twisting, printing, riveting, welding, soldering, cutting, etc.). The student utilizes an auto-tutorial tape, which is a verbatim transcript of the written material. This permits some level of self-pacing and is reported to aid some students in reading comprehension. The software material in the Level I program acquaints students with a sizable variety of information concerning fifty occupations. This is generally more occupational information than would be in a traditional "let's make a woods project-go to work" kind of junior high industrial arts education experience.

The strength of the program appears to be the student activities (projects) and the related occupational information that is designed around the activity. The students reported that they saw a relationship between what they were doing on their small projects and what a worker would do in industry. The students were observed to be

actively and independently engaged in these activities while the instructors were serving primarily as resource people, facilitators, and evaluators. A research study (5) suggested that students who experienced IACE had learned equally well about materials, tools and processes when compared with students who experienced a traditional industrial arts education program. In addition, students experiencing IACE seem to be more aware of careers. The students reported freely the activities (jobs) that they liked and disliked, and even 7th graders had some understanding of the DATA-PEOPLE-THINGS paradigm that was incorporated into the modules.

Since the program does have a variety of activities that students can engage in, then more of the industrial processes are represented than would be "normal" in a regular "single shop" 7th grade experience. Many of these "hands-on" activities that the students complete result in take-home projects of very low cost (25-50¢). The cost of consumable materials for the Level I modules is reported to be from five to six dollars per student. This is economical for a 7th grade laboratory experience. These projects not only use the project method of industrial arts to facilitate student interest, but also to convey occupational information about what kind of workers engage in this kind of activity for employment. Incidentally, all activities involving measurements utilize the metric systems.

In its development and implementation, the IACE has had several strengths. It is a "grass-roots" effort involving twenty teachers and the state department of education. Throughout the entire IACE developmental effort, the project staff and teachers have been constantly aware of the "average" industrial arts teachers' and students' interests and competencies and so projects have been designed to fit these standards. Because of this, one of the strengths of the program is that teachers and students can operate the program with minimal special training. Of course, to develop the IACE program further and to expand its goals, additional training and in-service development are required.

Another strength of the program is the level of professional and personal pride in the IACE program and this has contributed greatly to acceptance of changes in orientation required of the teachers. In every school, and at the state department level, there appears to be a great deal of interest and excitement about the IACE program. Administrative personnel are strongly in favor of this approach to career education through industrial arts. Similar programs are being proposed in home economics, business, distribution, science, mathematics and perhaps others. This is in contrast to the criticism expressed concerning the inappropriateness of the traditional woods and metals courses. No doubt the success of the IACE program can be attributed in part to the

charismatic quality of Joe O. Luke. The leadership of Mr. Luke and the excitement of the teachers have been necessary to initiate this effort.

The funding arrangement is also a strength of this effort in that costs are divided equally between the local school and the state department of education. This supports the developmental effort, but also requires a local commitment.

The program itself appears to assist in reducing sex role stereotyping since all students (boys and girls) go through the occupationally related activities. The program inherently develops uniformity from school to school in that at Level I the modules are designed to be self-operational and at Level II and Level III the resource material and project ideas will be consistent. This program also appears to be adaptable to a variety of laboratory sizes and types. The program is especially appropriate for open classroom type management and for multi-purpose general comprehensive laboratories. The modules utilized for Level I are now commercially available and if the price can be kept reasonable, these should aid non-project involved teachers to explore the appropriateness of this method for their school.

Limitations and Dangers Associated With the IACE Program

Industrial arts has had a variety of educational objectives which attempt to give direction to the field. One of these objectives has been to provide students with the opportunity to explore occupations associated with American industry. The IACE program, in response to the perceived vacuum in this area of occupational information and exploration, has taken this one objective of industrial arts and has accented it. This appears to have limited the scope of the current IACE program. Not only are a limited number of "jobs" represented, but for the most part, these jobs are blue-collar, trade, and industry type jobs. Students learn mostly about blue-collar occupations and very little about other types of occupations. An analysis of the fifty jobs scheduled in Level I of IACE, indicated that only 16% were found not related to the trades and industry (T & I) category as listed by the Office of Education code numbers. The rationale is given that 80% of the jobs can be found in the blue-collar occupations.

If the job market is to so strongly influence the content of industrial arts education, then many of the objectives of industrial arts may be lost. In addition, the student-centered instructional modules utilized during Level I of the IACE program could be removed from the

industrial arts laboratory and its operation be monitored by anyone not holding an industrial arts certification. In discussion with other state department personnel, it was indicated that plans are being generated to develop an exploratory curriculum, similar to IACE, in other areas of vocational education including business and office education, agricultural education, home economics education, health occupations education, as well as the academic areas of science and mathematics. There appears to be a movement to divest industrial arts of its general education "identity" at the 7th grade level and possibly establish a Career Exploratory Center in its place. This is further supported by the fact that vocational directors, administrators, and some teachers reported that they saw this program at the junior high school level as a feeder program for vocational education.

Understanding that the traditional woods and metals programs that IACE has expanded on were perhaps less broad in their representation of American industry, it is of paramount importance that this program be made more representative of industrial technology and careers, not just jobs. The general process of developing the IACE program from what teachers know about certain activities and how these activities can be applied to specific jobs is <u>not</u> an adequate, systematic orientation to the selection of industrial arts content. Little evidence is observed of the IACE program developing in the student a broad understanding of the industrial society or his/her role as a consumer or decision maker in that society. This is thought to be one of the most glaring faults of the program and most threatening to the adoption of the program outside of Utah. Some of the people who are involved in IACE are aware of this limiting emphasis and reportedly are broadening the scope of the program.

Although obtaining some vocational funding was desirable and justified, there appears to be an over-emphasis on trades exploration, while a major thrust of the federal definition of industrial arts (part "A," to be explicit) has been "put on the back burner" for now. Specifically (from Public Law 94-482, Title II, Part C, Sec. 202):

> (15) The term "industrial arts education programs" means those education programs (A) which pertain to the body of related subject matter, or related courses, organized for the development of understanding about all aspects of industry and technology, including learning experiences involving activities such as experimenting, designing, constructing, evaluating, and using tools, machines, materials, and processes and (B) which assist

> individuals in the making of informed and meaningful occupational choices or which prepare them for entry into advanced trade and industrial or technical education programs.

Again, there is no attempt to adequately provide students with some of the major awarenesses that are cited as the objectives of IACE. Of the joint objectives of AIAA/AVA for industrial arts education (1974) (see page 9), it appears that the one objective that has the greatest impact is #6, which relates to developing an "understanding of career opportunities and requirements in industrial pursuits..." It appears that at this stage of development, the IACE program severely limits the objectives of industrial arts to an exploration of jobs that have a T & I counterpart.

The selection of the jobs within each cluster is done by identifying those that had certain inherent commonalities and is based on constraint analysis of the following criteria:

1. Facilities, tools, and equipment (local)
2. Teacher experience and educational background (local)
3. Employment projections (Utah)
4. Worker trait characteristics (DOT)

Because items #2 and #3 are specific at the local and state level in Utah, the selection of jobs to be studied would not necessarily be the same for other locations outside the state of Utah. This is especially true if this program were to vie for recognition and support with comprehensive industrial arts programs in the clusters of construction, manufacturing, communication, and transportation.

Although one of the objectives of IACE that has been pointed out in a variety of written material and in conversations with teachers is the "development of technological literacy," there was no direct linkage made between the student's activities and how he or she could use this knowledge or skill except as it relates to a particular occupation. Students do not appear able to transfer learned tasks to other jobs or job clusters. Although emphasis is placed on occupational information during Level I of the IACE program, none of the students questioned were able to comment on how or where the learned skills could be used elsewhere. They only knew that the skills applied to the job under investigation. "Technological literacy" is not defined except as to assist the student in using tools,

materials, and processes. This may be analogous to reading literacy defined as the recognition of the letters of the alphabet and the combining of these letters to produce words. Literacy, reading or technological, implies using the capability at a much higher level of comprehension. The question persists as to whether or not a student going through this program at all three levels would have any greater understanding of American industry and its role in society than he or she would have in a traditional industrial arts program.

In observing the program in operation and talking to the developers, the teachers, and the students, the following observations have been made in support of some of the potential dangers and limitations of the IACE program.

*This program would definitely change the intent of industrial arts and, unless the curriculum is appropriately broadened, it could cause the loss of identity of industrial arts education and the relegation of middle school/junior high industrial arts to the sole role of serving a preselection/prevocational experience leading to trades and industrial applications.

*Since the development of the student activities (projects) have been developed by the teachers on the criteria of student appeal, many of the activities only remotely relate to a true industrial type activity and when these activities are matched with jobs, these jobs over-represent certain levels and types of occupations in a cluster. No analytical determination of what constitutes representative careers in the four clusters is apparent.

*Non-industrial arts certificated teachers could conceivably operate this program at the Level I stage. This is a real danger when it is the stated purpose of the leadership to develop similar kinds of career (job) exploration programs for home economics and business education. In effect, a paraprofessional or a person trained in any educational area could operate the Level I program. This facet of the IACE could be construed either positively or negatively, depending on the educational environment.

*Although the program is in the developmental phase (3rd year), no attempt has been made to determine what cognitive, psychomotor, and affective learning has occurred. This data is badly needed to counteract the "halo" effect that arises from any program implementation. The teachers are excited about the program. They report that it is better than "bench-woodworking" but this may be due to a number of "project" factors and since no data concerning student learning is available, no real assessment of this factor can be made at this time.

Summary

The IACE program, in keeping with Utah State Board for Vocational Education directives, is designed to give job related information and skills for specific occupations to middle school/junior high school students. The program effectively incorporates modern learning theory concerning individualized, multi-media programming into an open-entry, open-exit system of instruction. The fifty modular activities developed by IACE acquaint the student with a wide-range of tools, materials, and processes relevant to specific trade and industrial occupations. The economics of the program are good; student projects are produced at low costs and the development of the modules themselves appears to have been cost effective.

Student enthusiasm for the program is high and there appears to be an increased awareness of the relationship between project activities and the specific industrial occupation under study. Support and enthusiasm for the program extends to the school administration and the State Board for Vocational Education. It is a "grass-roots" effort that apparently responds specifically to internally perceived needs in the industrial arts classrooms in Utah. Teachers and project staff take pride in the IACE program and this is reflected in the mutual funding arrangements between state and local educational agencies.

While essentially effective in meeting its career exploration goal, the IACE program has several limitations associated with it. Most generally, it is noted that the objectives of industrial arts education appear to have been disproportionately emphasized, with career exploration in trades and industries having become the predominant goal. Specifically, the selection process relating to occupations that were included in the activity modules appear somewhat arbitrary. Failure to establish links between the learning of skills and information associated with a specific trade or industry and the student's use of this knowledge in relating to broader career concerns or general consumer interests leaves the program short of providing maximum "technological literacy." A final criticism is aimed at the lack of research efforts being conducted in order to guard against a "halo effect" kind of acceptance of the program. Careful evaluation of the educational effects of the program is needed.

While the IACE program is to be applauded for its effort to infuse career education concepts into the industrial arts curriculum, the profession cannot safely abandon its general educational goals and assume that one goal addressed to career education supersedes the sum of the

remaining goals. Section 3 of this report attempts to expand on these criticisms in the light of the long-range implications the IACE program may present to industrial arts education.

Section 3

LONG-RANGE POLICY IMPLICATIONS OF THE IACE PROGRAM

This examination of the Utah model (IACE) has confirmed that, indeed, both industrial arts education and career education are being re-examined and redefined "in the light of the emerging needs of our society." If career education is defined as awareness, exploration, and preparation for a job or an occupational cluster of jobs, then the suggested role for industrial arts education in realizing these goals would be that of a contributor in alliance with other educational disciplines. Industrial arts education would, however, retain (as would the other specialized educational disciplines) its distinguishing set of unique goals and objectives. It appears that the IACE program has highlighted this job exploration goal, while to some extent under-emphasizing the other five goals of industrial arts (AIAA/AVA, 1974). The long-range implication of this kind of "change" in industrial arts is that industrial arts would most likely serve as a feeder program to T & I. This would be deleterious to the broad-base of industrial arts education and, since this is even narrower than the definition of industrial arts in the vocational amendments, then it does not seem appropriate that industrial arts limit its scope and sequence of activities to what workers do and how 7th, 8th, and 9th graders can explore these selected occupations.

Specific long-range policy implications for change in the industrial arts field growing out of the Utah model are discussed below. They are organized under the following three headings: Implications for Teacher Education, Implications for Federal/State Legislation, and Implications for Teacher In-Service Programs. The final heading has marked off a summary of general conclusions and recommendations that were formulated by the assessment team and are specifically addressed to the American Industrial Arts Association, the United States Office of Career Education, and the Utah State Board for Vocational Education.

Implications for Teacher Education

The implications for teacher education are numerous. Many teacher education institutions that prepare teachers for a unit shop orientation would, if this program

implementation were the goal, have to provide the preservice teacher with broader training in the clusters of construction, manufacturing, communications, and transportation. In conjunction with this, the teacher education programs may have to be redirected (or continue to be directed) toward a training of a more generalist type of teacher and perhaps special certification for middle school and junior high type exploratory programs. It is possible that other certificated teachers or perhaps paraprofessionals could manage the Level I program. The 10th, 11th, and 12th grade industrial arts programs may need to be re-examined in light of the exploratory approach taken at the middle school and junior high school.

If the IACE program was considered by a teacher education institution as appropriate for the middle school/junior high school industrial arts program, future industrial arts teachers would need to be provided with trade and job analysis techniques so that they could identify the tasks and activities that workers do so that they could then design instructional modules based upon those activities. Specifically, preservice industrial arts teachers would need to be trained in the use of the Dictionary of Occupational Titles, and other sources of job related information. Instruction in managing multiple activity, open-entry, and open-exit laboratories and experience in designing individualized instructional systems would have to be incorporated into the teacher education program. Some additional attention would also be appropriate in the preservice program regarding the intent of career education and the need to design appropriate industrial arts activities that are directed toward career awareness, exploration, and preparation. These preservice teachers might also be given experiences in designing activity based modules that deliver industrial arts content and meet all of the objectives of industrial arts.

Implications for Federal/ State Legislation

Industrial arts in every state should be incorporated into the state plan for vocational education and the state plan for career education. All states should have an approved Five Year Plan for Vocational Education as well as a Five Year Plan for Career Education. An annual updating of the above plans is mandatory. Industrial arts professional associations at the state level should be encouraged by the American Industrial Arts Association (AIAA) to give testimony at the public hearings on these plans and strongly indicate how their industrial arts programs are carrying out the purposes of the congressional acts that support the state vocational and career education plans.

In the area of legislation, it is appropriate that career education be funded so that pilot programs can be generated in industrial arts education that will address the comprehensive concerns of career education. In regards to vocational legislation, it should be pointed out that the IACE program primarily accents the prevocational role of industrial arts education and programs need to be explored that accomplish this task but not to the detriment of the other (vocationally fundable) objectives of industrial arts. The AIAA legislative network must be utilized to maintain a strong lobbying effort to appropriate monies after congressional bills are signed into law. If funds are available through career education, the legislation should not be so prescriptive as to limit the expenditure of those funds for specific programs such as IACE, but should rather permit the local and state leaders to choose from all available programs the one(s) that best meet their needs for career education or to develop their own efforts in this area. Any federal or state legislation that is designed to support career education should consider all aspects of career education, not only the occupational exploration and preparation aspect.

Implications for Teacher In-Service Programs

Implications of the IACE program for in-service teachers of industrial arts are varied. In-service workshops might prove most effective as the vehicle for implementation of the program by LEAs. Dollar assistance probably would be necessary for summer workshops and teacher module development. One of the strengths and benefits of the IACE program is that the teachers who were implementing it developed the modules in a group setting. This ownership affected their desire to carry out the program. Motivational factors of this nature should be considered in any workshop delivery system that is designed to implement such a program. In addition, in-service programs may be necessary to provide teachers who wish to implement this type of program with training and experience in working as team members and working in a setting where more than one teacher has responsibility for a laboratory and for the instruction.

Each of the learning modules used in Level I of IACE needs to be fully understood by the teacher. The in-service program should emphasize (1) classroom organization and management, (2) how to effectively use the learning modules, and (3) how to understand and use the Dictionary of Occupational Titles. If any of these three components are missing, there is little chance of success in implementing a career education program similar to IACE.

Summary

The assessment team has concluded that the IACE developmental effort provides middle school/junior high school students with a broader representation of industry and the practices of workers than a traditional woods and metals course at this level. The program is more occupationally oriented than most industrial arts programs and although it does provide substantial experience with tools, materials, and processes, the program could be expanded even more if each Level I activity in the program did not have to be tied to a particular job title or DOT number. On the other hand, Level II activities might require greater emphasis being placed on the concept of the worker trait grouping (WTG) system in order to avoid having these activities revert back to their traditional industrial arts counterparts. The selection of activities does not in any event represent a systematic study of the content of industrial technology nor does it treat all the objectives of industrial arts equally.

The emphasis on the student activity or project in the IACE program implies, however, that this aspect of industrial arts has continued merit and should be considered when examining alternatives to traditional industrial arts. The individual take-home project and the subsequent student interest generated by this activity suggests that some attempts to relegate industrial arts to classroom discussions <u>about</u> industry and technology would <u>not</u> be well received by the practicing teacher or his/her students. Although the IACE program reportedly is broader based than the traditional woodworking and metalworking that it has expanded upon, the association and the profession should exercise caution in regard to focusing industrial arts curriculum on the tasks that workers perform or the careers that are available through T & I training. Every effort should be made to expand the IACE program to include a variety of careers in industry, the home, leisure time pursuits, and a broader concept of technological literacy.

With these conclusions in mind, the assessment team's recommendations directed at the broadly based concerns of the AIAA and OCE are as follows:

1. Legislation, which will cause improved opportunities for students in industrial arts education, needs to be continually encouraged and promoted.

2. There should be a master plan developed to include all levels of industrial arts career exploration as well as the entire scope and sequence of approved industrial arts offerings.

3. Further encouragement by AIAA for middle school/junior high schools to adopt the concept of a career exploratory program should continue. This might be accomplished by:

a. The AIAA, as the professional organization exclusively promoting industrial arts, serving as a catalyst for a national forum on significant curriculum developments and/or improvements in industrial arts. (This could be an invitational program open to a selected number of participants from each state. The IACE program could be one of several considered for a presentation.)

b. Possibly a national industrial arts curriculum conference to be held simultaneously in each of the five recognized regions of the U. S. would be feasible and would encourage greater teacher participation than a large conference at a national level.

4. A national policy needs to be further defined and possible U. S. Office of Education (USOE) regional meetings established in order to organize and/or initiate in-service programs for local educators. The main purpose of this in-service program would be to help teachers better understand the career education concept and to utilize it at the middle school/junior high school level.

5. Industrial arts, as it continually searches for improved content and methodology, should not be limited to one program for total endorsement. Instead, there is a need for a variety of alternatives to be considered for implementation.

6. The American Industrial Arts Association should make every attempt to professionally examine and discuss developmental programs such as IACE. This might be accomplished through a regular feature in the AIAA's journal, Man/Society/Technology related to recent curriculum efforts. This may be as appropriate as the recently initiated section on "projects" and may have a great impact on the profession as it constantly examines its programs in light of its long standing objectives.

Specifically, with respect to the Utah model, it is recommended that:

7. The Utah State Board for Vocational Education should be commended for its foresight on implementing the IACE program. It appears to be highly motivational in the contemporary industrial arts laboratory. IACE has been accepted by educational leaders, industrial leaders,

vocational administrators, teachers, and students.

8. The AIAA and the Office of Career Education (OCE) should encourage IACE to broaden its content of industrial technology and focus its curriculum on the many career roles that an individual will have in relationship to industrial technology.

9. The IACE program, along with many different career exploration programs, should be funded by OCE and data should be collected regarding the programs' objectives, operation, and effectiveness.

10. This program should be further studied for its "benefits and costs" in relation to: adequate representation of career education goals; adequate representation of industrial arts content; the relationship of IACE as a "feeder program" to T & I programs; the danger of industrial arts being eliminated from the school program in favor of a "comprehensive prevocational experience;" and the effect on certification and training of industrial arts teachers in light of this type of program.

11. Utah should be encouraged to conduct longitudinal studies over a two, four, and eight year period to see if the students in the IACE program differ from other industrial arts or non-industrial arts students in their career selection, career knowledge, psychomotor, cognitive, and affective learning about industry and technology.

12. Utah should be encouraged to write articles on the IACE program for AIAA's Man/Society/Technology.

13. Research efforts should be undertaken to determine what cognitive, psychomotor and affective learning has occured as a result of IACE. The IACE program currently is void of any assessment/evaluative data. Funding in this area would be appropriate to help Utah complete the much needed research so that others could see the value of the IACE program as well as determine how well the program does what it purports to do.

14. Whereas this program development effort is primarily an adjunct responsibility of the state industrial arts specialist and a teacher educator who maintain full-time responsibility for their established positions, and whereas this is a program of significant impact on the secondary curriculum generally and very specifically to industrial arts education, this program development should be strengthened through a bona fide curriculum development project.

15. An IACE program director needs to be appointed with the responsibility to carry out the needed research and

to complete the development of Levels II and III.

Therefore, within the context of recommendation 15, the following more specific recommendations are made:

16. Activities for Levels II and III should give more attention to developing an insight and understanding of technology and industry and their place in society and the free enterprise system.

17. Student learning activities should be validated through a significant analysis of what workers do in relationship to worker traits, work styles, and other universal characteristics from which timeless adaptations can be made by the student.

18. Provision for certain activities that utilize group dynamics rather than being exclusively individualized in instructional procedures should be developed further.

19. The program should include a means for synthesizing the career information and student profile for each level.

20. Concise and descriptive brochures telling about the total Industrial Arts Career Exploration program need to be developed.

In conclusion, the assessment team is impressed with the cooperative working relationship that has been observed between the state and local districts involved in IACE. The curriculum and instructional development that has gone into IACE is significant, and the replacement of a traditional "lets-go-to-work" kind of metals or woods course with IACE is an attempt to revitalize the curriculum. However, there are dangers inherent in this effort and much additional developmental effort is required to make IACE truly representative of all goals of industrial arts. IACE is a developmental effort that has potential for constructive change in industrial arts education and every effort should be made by AIAA/OCE and Utah to further this broad-based career education/industrial arts program.

Career education is a vital concept that deserves our continuing support. The important role that industrial arts education can play in facilitating the implementation of career education concepts has been admirably recognized and developed by the Industrial Arts Career Exploration program in Utah. The strengths of the IACE program cannot be overlooked and, as certain weaknesses are overcome, a better program can be developed to meet the needs of the students of today who are going to live out the majority of their lives in the 21st century.

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APPENDIXES

APPENDIX A

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APPENDIX B

TITLES AND ACTIVITY DESCRIPTIONS OF LEVEL I MODULES

TITLES AND ACTIVITY DESCRIPTIONS
OF LEVEL I MODULES

MODULE TITLE	ACTIVITY DESCRIPTION
Transportation Cluster	
1. Aeronautical Engineer	Design and fabricate a rocket using balsa wood
2. Aricraft Designer	Design and fabricate a glider using balsa wood
3. Airplane Pilot, Commercial	
4. Auto-Body Repairperson	Repair a dent in a fender
5. Auto service Station Attendant	Service and operate a multi-cylinder engine
6. Bicycle Repairperson	Repair a leaking tire
7. Gas Engine Repairperson	Service a small gas engine
8. Marine Engineer	Design and fabricate a model boat
Communication Cluster	
13. Announcer	a. Prepare and record an audio tape b. Broadcast a newscast
14. Compositor I	a. Set type b. Print a series of name cards
15. Draftsperson	Complete an isometric drawing of an item
17. Painter, Sign	Layout and print a sign
18. Photographer, Commercial	Expose and develop a print
20. Screen Printer	Print a design using silk screen method

MODULE TITLE	ACTIVITY DESCRIPTION
Manufacturing Cluster	
25. Electric Appliance Repair	Connect a plug to a section of cord
26. Electronics Assembler	Assemble a solid state flashing light
27. Foundry Worker	Cast an aluminum figurine
28. Furniture Upholsterer	Upholster a pin cushion
29. Jeweler	Fabricate a coin ring
30. Leather Worker	Make a key fob/barrette - using leather
31. Machinist	Make a key lock
32. Metallurgist	Fabricate an offset screw-driver using steel rod
33. Molder, Hand Ceramic	Mold a vase using clay
34. Ornamental Iron Worker	Fabricate a sign bracket
35. Ornamental Metal Worker	Make a wall plaque from copper
36. Plater	Form and electroplate a ring
38. Sheet Metal Worker	Cut and form a utility rack from sheet metal
39. Textile Worker	Make a hot pad using textile material
40. Welder, Combination	Fabricate a figurine by welding
Construction Cluster	
43. Architect	Layout a room to scale
44. Bricklayer	Lay a course of brick
45. Cabinet Maker	Cut out and finish a sign

MODULE TITLE	ACTIVITY DESCRIPTION
Construction Cluster (con't)	
46. Carpenter	Fabricate a scaled "A" frame
47. Cement Mason	Form a cement block using a mold
48. Dry-wall Applicator	Install a section of dry-wall
49. Electrician	Wire a light circuit
50. Glazier	a. Remove and replace a window pane b. Cut a section of glass
51. Plumber	a. Remove/replace washer b. Cut threads in galvanized pipe c. Solder a cap on copper tubing
52. Surveyor	Layout a plot to scale
53. Tilesetter	Lay a section of tile

APPENDIX C

PROJECT BUDGET

PROJECT BUDGET

PART A - BUDGET REQUEST 1975-76 FED. PART D

		AMOUNT
1.	Project coordinator for three (3) months summer; one (1) month equivalent (part time) winter work.	$ 6,991.00 2,333.00
2.	Technical writer and illustrator for three (3) months	4,125.00
3.	Secretary (typist) for three (3) months	1,150.00
4.	Travel for coordinator and technical writer	1,000.00
5.	Printing	3,000.00
6.	Pre-testing RCU	
7.	Other RCU activities	
8.	Travel and miscellaneous expenses for the special advisory committee	1,000.00
9.	Facility, tools and equipment guidelines - research and development cost	1,200.00
10.	5% of total project cost for miscellaneous contingency budget	5,596.00
	TOTAL PART A - FED. PART D	$26,395.00

PART B - BUDGET REQUEST 1975-76 FED. PART D

		LEA	PART D	TOTAL
1.	Salary for fifteen (15) industrial arts instructors @ $50.00 per day for 50 days (ten weeks).	$18,750.00	$18,750.00	$37.500.00
2.	Part time salary for fifteen (15) industrial arts instructors during the school year for one (1) hour per day for 180 days @ $6.25 per hour.	8,437.50	8,437.50	16,875.00

3. Housing allowance for industrial arts instructors @ $25.00 per week for ten weeks.	1,875.00	1,875.00	3,750.00
4. Travel for industrial arts instructors	1,500.00	1,500.00	3,000.00
5. Instructional materials and special equipment estimated at approx. $5,000.00 for each pilot school.	15,000.00	15,000.00	30,000.00
	LEA	PART D	TOTAL
TOTAL PART B - FED. PART D	$45,562.50	$45,562.50	$91,125.00
TOTAL PARTS A & B			

SCHEDULE OF MATCHING FUNDS

		PART D*	LEA**
3	Granite School District	$8,612.50	$8,612.50
2	Nebo School District	6,575.00	6,575.00
2	Washington School District	6,575.00	6,575.00
3	Logan School District	8,612.50	8,612.50
3	Davis School District	8,612.50	8,612.50
2	Weber School District	6,575.00	6,575.00

* The additional State Vocational Funds will flow directly to each district in the amount specified above.

** LEA's may use regular state vocational funds as matching funds for the proposed pilot program.